U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-273 842

Treatment and Stabilization of Polychlorinated Biphenyls (PCBs) Contaminated Water and Waste Oil A Case Study. Whitehouse, Florida

Environmental Protection Agency, Atlanta, Ga. Region IV

Jul 77

PB 273 842

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

TREATMENT & STABILIZATION OF PCB CONTAMINATED WATER AND WASTE OIL

A Case Study

U.S. Environmental Protection Agency
Region IV Atlanta
Environmental Emergency Branch

July 1977

Raymond T. Wilkerson (OSC)
Fred B. Stroud
Al Smith

ia

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No.
4. Title and Subtitle: Treatment and Stabilization of PCB Contaminated Water and Waste Oil - A Case Study			5. Report Date: July 1977 6.
7. Author(s): Al Smith - Fred Stroud - Ray Wilkerson			8. Performing Organization Rept. No.
9. Performing Organization Name and Address: U.S. Environmental Protection Agency, Region IV 345 Courtland St., NE Atlanta, GA 30308			10. Project/Task/Work Unit No.: Spill Study 11. Contract/Grant No. [redacted]
12. Sponsoring Organization Name and Address: above			13. Type of Report & Period Covered: Technical June 76 - June 77 14. 904/004

15. Supplementary Notes: Presented to the 1978 National Conference on Control of Hazardous Material Spills, Miami, Florida

16. Abstracts: A study was made concerning one method of treating a substantial Environmental Emergency and potential health hazard. The U.S. EPA, the City of Jacksonville, FL and the U.S. Coast Guard fomulates an inexpensive treatment system that allows the discharge of a mixture of oil, PCB & water harmlessly into the St. Johns River. The emergency stems from the poor structural integrity of the impoundment dikes.

17. Key Words and Document Analysis. 17a. Descriptors

PCB Stabilization
Hazardous Materials spills.
Whitehouse, FL
St. John River FLA
polychorinated biphenol
Contingencies hazardous materials

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

REPRODUCED BY NATIONAL TECHNICAL INFORMATION SERVICE U.S. DEPARTMENT OF COMMERCE SPRINGFIELD, VA. 22161

18. Availability Statement: Release unlimited	19. Security Class (This Report): UNCLASSIFIED	21. No. of Pages: 35
	20. Security Class (This Page): UNCLASSIFIED	22. Price: A03 - A01

ACKNOWLEDGEMENTS

This report reflects an insitu solution to a significant PCB problem. While many people and agencies contributed significantly, several individuals distinguished themselves through unceasing efforts. Invaluable service was rendered by Messers. Walter Honour, Tom McClamma, and Gary Weise of the City of Jacksonville, MSO Jacksonville, United States Coast Guard, Commander Bill Monson and the USCG Gulf Strike Team, and the Organic Unit of the Surveillance and Analysis Division, EPA, Region IV. It is noteworthy to mention that this is not a research effort, conclusions must be tempered with an awareness that this was an emergency cure of a dangerous situation. Time and public health were of essence. None-the-less the study does indicate that a potential exists for economical and practical relief for what may become a serious problem in the next few years.

TABLE OF CONTENTS

		Page No.
I.	Summary	1
II.	Historical Background	2
III.	The Problem	3
IV.	The Solution	8
	A. Description of the Pits	8
	1. Physical	8
	2. Chemical	9
	B. Alternative Courses of Action	9
	C. Solution - Carbon Adsorption Treatment System	13
V.	Comments	19
VI.	Appendices	24

SUMMARY

Historical uses of Polychlorinated Biphenyls (PCBs) coupled with today's identification of the environmental and health hazards of this chemical bring us to the realization that promiscuous dumps exist throughout the Country. It is not uncommon for example to find huge pits of water, oil, and PCB mixtures in or around metropolitan complexes. Since the origin of such problems is a problem itself, it is not surprising to find the structural integrity and longivity of these pits to be poor at best. Such is the case presented here. Through the diligent efforts of the City of Jacksonville, Florida, the cooperative team work of the U.S. Coast Guard and EPA acting through the National Oil and Hazardous Materials Spill Contingency Plan, what could have been an environmental and health disaster was converted into a harmless disarming of these waste pits.

HISTORICAL BACKGROUND

On June 29, 1976, the Environmental Protection Agency Region IV, through its Environmental Emergency Branch of the Enforcement Division, became involved in a 200,000 gallon oil spill from a waste oil pit in Whitehouse, Florida. This pit was one of a series of six abandoned waste oil pits located near Whitehouse, Florida, approximately 10 miles West of Jacksonville. (See Photos #1 & 2).

Original Pits June '76
(Photo #1)

Pit #6 Closeup June '76
(Photo #2)

From various on-scene sources contacted, it was established that Allied Petroleum, a waste oil reclaimer, constructed the first of these pits in about 1958. Allied used the pits

to dispose of waste oil from their process for some ten years until about 1968 when the company filed for bankruptcy. It was rumored that various companies, including a General Electric transformer repair shop, used the pits for disposal after they were abandoned by Allied.

About 1968 the pit designated as No. 7 (Figure #1) ruptured spilling its contents onto adjacent private property and into McGirts Creek. The City of Jacksonville Mosquito Control Branch, recognizing the threat of other pits rupturing if the water level was not controlled, began building a two-cell oil water separator in conjunction with a limestone filter to try to dewater the pits. Because of budget problems the Mosquito Control Branch was forced to abandon the project.

This report not only provides historical background on the spill situation, but it will also reflect the myriad of problems the EPA On-Scene Coordinator (OSC), Mr. Raymond Wilkerson, encountered while attempting to coordinate cleanup efforts with local, State, and Federal agencies.

THE PROBLEM

On June 29, 1976, workmen from the Mosquito Control Branch were attempting to repair a dike wall on Pit No. 6 (Photo #2)

when it failed and spilled approximately 200,000 gallons of waste oil and an undetermined amount of highly acidic water into McGirts Creek. At this time there was no expressed knowledge of PCB involvement.

The EPA OSC responded to this spill under the impression that the City of Jacksonville was responsible for the waste oil pit from which the spill occurred. A contractor was hired by the city to clean up McGirts Creek with the expectation that it would only require two or three days. At this point in time the oil spill was still considered to be routine.

The first problem the OSC encountered was finding no representative from the City or State at the spill site when he arrived. Three hours after the OSC requested assistance, a city representative appeared and denied any responsibility for the spill or the remaining oil pits. It seems that certain other individuals working for the city had been trying desperately for several years to obtain funds from the State and local governments to dispose of the pits. Mr. Walter Honour, for example, had started a dewatering operation with limited funds that the State had actually allocated to the city's Mosquito Control Branch for another project. These funds were threatened when it was learned they were being used for this operation. Had

this project been allowed to continue, the 200,000 gallon spill might have been avoided.

After the OSC enacted a Federal response to the oil spill, disposal became the next major obstacle. The disposal site of the oily material removed from the stream was 25 miles away on a large (approximately 1,000 acres) area of dunes being reclaimed for commercial use. (See Photos #3 & 4).

(Photo #3)

(Photo #4)

Initial Disposal Site

The material was applied in thin layers and plowed into the soil. This area was also being used as a disposal site for STP sludge, septic tank waste, and some industrial waste. The initial plan to eliminate the imminent threat of another spill

was to pump out the pits and dispose of the material in a proper manner. It was requested by the Federal OSC that the City, State Solid Waste, and EPA Solid Waste locate a disposal site for the material. The City proposed several sites but could not get approval from the State to use them. Because of the lack of a disposal site or method, a ten-day delay was encountered. Fortunately no extended rains occurred during this period.

The delay allowed the OSC to become more familiar with the material in the pits. It was determined that the only feasible means of disposal was to reactivate the oil water separator and filter system the City had employed during their effort to dispose of the pits. This would allow the pits to be dewatered and eliminate the threat of another major spill. The City of Jacksonville suggested that after the pits were dewatered they would mix the remaining oil and sludge with dry trash and dirt and fill all the pits. They also agreed to monitor the effluent from the treatment system for heavy metals and residual oil.

The dewatering operation was one day from startup when the OSC received word from Commander Monson of the U.S. Coast Guard Strike Team that there was a possibility the oil in the pits was contaminated with PCBs. Until now, this had been handled as an oil spill utilizing the Regional Response Team,

the U.S. Coast Guard Strike Team, and Federal Contingency Funds. This new information not only halted the entire operation but required chemical analysis of the material in the pits.

At the request of the OSC, a sampling team from the EPA Athens Laboratory was dispatched to the scene to sample the pits and selected points in McGirts Creek. These samples were obtained only from the side walls of the pits. No bottom sludge samples were obtained due to the unknown depth and the hazards involved in reaching the center of the pits. The pH in the pits had been measured at 1.0. The analyses indicated that PCBs were present in the sludge of five of the six oil pits. The sludge samples revealed concentrations of PCBs ranging from 8.7 ppm to 23.3 ppm. Normally PCBs are, for all practical purposes, insoluble in water but in an oil water mixture at low pH they become soluble. For this reason, it could be anticipated that PCBs would be found in any discharge from the pits.

It is interesting to note that in the absence of a standard method for extracting PCBs from oil sludge, Mr. Bill Loy, of the EPA Laboratory adapted, for this purpose, a silican gel method designed to analyze for organics in process waters.

According to information published in the Federal Register (Vol. 41, No. 64) by EPA on April 1, 1976, the only approved

methods of disposal of "Polychlorinated biphenyl - containing wastes" is incineration or controlled land disposal. These methods were considered but due to the magnitude of contaminated material they were abandoned. This meant that if the pits were to be dewatered a treatment system that was capable of reducing the concentration of PCBs to an acceptable limit, would have to be designed and constructed. Mr. Fred Stroud, Environmental Emergency Branch's specialist in activated carbon application, was asked to assist the OSC on this project.

THE SOLUTION

Description of the Pits

Physical

Originally there were seven waste oil pits constructed by a waste oil reclaimer for use in the reclaiming process. The pits lay in an east-west direction approximately ¼ mile north of State Highway 90 in Whitehouse, Florida, and had a surface area of approximately five acres. The depths of the pits ranged from an estimated five feet to as much as 15 feet. An overview of the site is sketched in Figure #1. (See Photo #1).

If a side view of the pits could have been drawn it would

probably have shown a layer of oil on the top, followed by a layer of water, and finally a thick layer of oily sludge on the bottom. Pumping operations revealed that these were not well defined layers. In one of the pits only scattered pockets of water were found under the top layer of oil, but the sludge layer was present.

Chemical

As previously stated, concentrations of polychlorinated biphenyls (PCBs) as high as 23.3 ppm were found in one of the walls of the waste oil pits. The complete results are listed in Table #1.

The samples were also analyzed by mass spectrometry for elemental composition. The results of those tests are summarized in Table #2. Quantitative tests were run for copper, lead, zinc, cadmium, and chromium. As expected they appeared in significant quantities. These are typical metals found in the waste oil process so these results were not surprising.

Alternative Courses of Action

After evaluating the data, three alternatives were considered by the Regional Response Team for the ultimate disposal of the PCB contaminated waste oil:

1. There would be no treatment of the water. All of the PCB contaminated waste oil would be put in sealed containers and shipped to an approved facility. A conservative estimate of the amount of contaminated material was made and using Rollins Environmental Services' price sheet, it was calculated that approximately $7.5 million would be needed. This estimate did not include labor charges. It was obvious from these cost figures, together with the fact that Federal Funds were not available (except for oil cleanup), that this was no longer a viable alternative.

2. The second alternative was to discharge the water with no treatment and dispose of the remaining oil and sludge at an approved facility. This alternative was finally rejected for two reasons: First, the cost of hauling the material seemed to be prohibitive as previously discussed. Secondly, data suggested that concentrations of PCBs exceeding 1 ppb could be expected in any water that discharged to McGirts Creek. At that time EPA was suggesting that manufacturers not exceed 1 ppt of PCB in any discharge. This prevailing attitude was interpreted by this office to mean maximum reduction of PCBs

by the most practical methods available. This alternative was rejected for essentially the same reasons as Alternate #1.

3. The third and final alternative was to immobilize the oil on site and to design a water treatment system that would produce an effluent of less than 1 ppb of PCBs. According to the Versar, Incorporated report, prepared for the office of Toxic Substances,* current technology is available for producing an effluent of 1 ppb using some form of activated carbon. This seemed to be the best of the alternatives.

Immobilization of the oil was assigned to the City of Jacksonville in conjunction with EPA's Residual Management Branch and Florida's Department of Environmental Regulation. Fullers Earth and dry solid waste were selected to stabilize the oil after the pits were dewatered. This entire series of filled pits was thereafter referred to as the "stabilization

*"Assessment of Wastewater Management, Treatment Technology, and Associated Costs for Abatement of PCBs Concentrations in Industrial Effluents."

Submitted to: U.S. EPA - Office of Toxic Substances

Submitted by: Versar Inc., Springfield, Virginia
February 3, 1976

site." (See Photo #5). Complete immobilization of the oil was completed May 15, 1977, at a cost of approximately $100,000.

Initial Stabilization Site
(Photo #5)

Closeup of Photo #5
(Photo #6)

The method of treatment to be used on the PCB contaminated water in the pits was assigned by the OSC Raymond Wilkerson to Fred Stroud of the Environmental Emergency Branch (EEB). A treatment system was to be devised that would be practical, inexpensive, easy to operate, and have the capability to reduce the PCB level below 1 ppb of all water discharged to McGirts Creek. In addition, the system was to be of a temporary nature and only minimum maintenance would be required to provide

continuous operation.

Solution - Carbon Adsorption Treatment System

It was obvious from the initial discovery of PCBs in the pits that the only effective treatment of the water would be with some form of activated carbon. Research and practical application have shown that carbon adsorption is the best available field method at this time for removing PCBs from wastewaters. Carbon adsorption systems in industrial applications will remove PCBs from wastewater effluents to a level of one ppb or less; however, these systems all employ a carbon adsorption column concept!

The carbon column was not the best method of treatment in this emergency situation for the following reasons:

1. The cost and time of constructing the columns was not advantageous; also, columns would have required additional pumps.

2. Due to the limited lab facilities nearby and the inconsistency of the influent it would have been difficult, at best, to determine when the carbon in the column had become saturated and useless.

3. The monitoring and changing of the carbon in the columns does not lend itself to being simple and practical as required. The oily water would tend to cover the surface

of the granular carbon and reduce its effectiveness for adsorption.

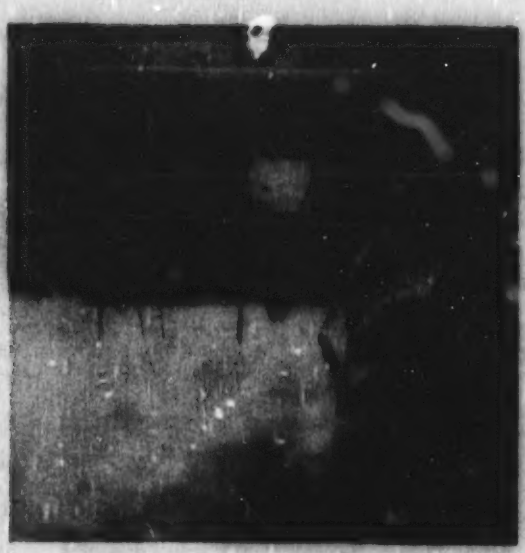
4. Granular activated carbon is twice as expensive as the alternative form of carbon (powdered) and the nearest source was approximately 600 miles from the spill site.

A system using powdered activated carbon for removing PCBs from water had never been employed in anything other than small scale laboratory experiments. According to the Versar, Incorporated report, these experiments all yielded treated effluent PCB levels well below the acceptable level of 1 ppb. With these results in mind and drawing on previous experience in the use of activated carbon for removing organics from water, a treatment system was designed using powdered activated carbon.

The carbon treatment system consisted of four units: 1) a collection sump; 2) a carbon mixing chamber; 3) a sedimentation basin; and 4) a sand filter. (See Figure #2).

Collection Sump - All water from the oil pits was drained by gravity into a collection sump adjacent to the carbon mixing chamber. When sufficient water was stored to insure a constant supply, the water was then lifted, by pump, to the carbon mixing chamber. The pump was rated at 60 gal/min. and could be used

continuously. (Photo #7).



Collection Sump
(Photo #7)

Carbon Mixing Chamber - A cement septic tank was modified to serve as a mixing chamber. The carbon was injected as a slurry to insure maximum contact time with the PCB contaminated water. Two 55-gallon drums were obtained along with two one-quarter horsepower mixing motors to provide a slurry mixing unit. In addition, a single head metering pump was purchased to inject the carbon slurry into the incoming stream of water from the collection sump. Twenty-seven (27) parts per million was the initial concentration of carbon added to the influent with future concentrations determined by sampling the effluent and adjusting accordingly to maintain an effluent concentration

of less than 1 ppb of PCBs. The mixing chamber was constructed with a series of baffles to insure thorough mixing of the carbon and influent flowing into the sedimentation basin. All flow through the remaining units was by gravity. (Photos #8 & 9).

Carbon Mixing Chamber
(Photo #8)

Carbon Slurry Mixing Unit
(Photo #9)

Sedimentation Basin - This unit was designed primarily to provide adequate detention time for gravity sedimentation of the organics and PCBs adsorbed by the carbon. It also acted as a safety factor by providing additional contact time between the carbon and the organics. The carbon-PCB sludge was removed when immobilization of the oil was completed and then incorporated into the stabilization site. Dimensions of the basin

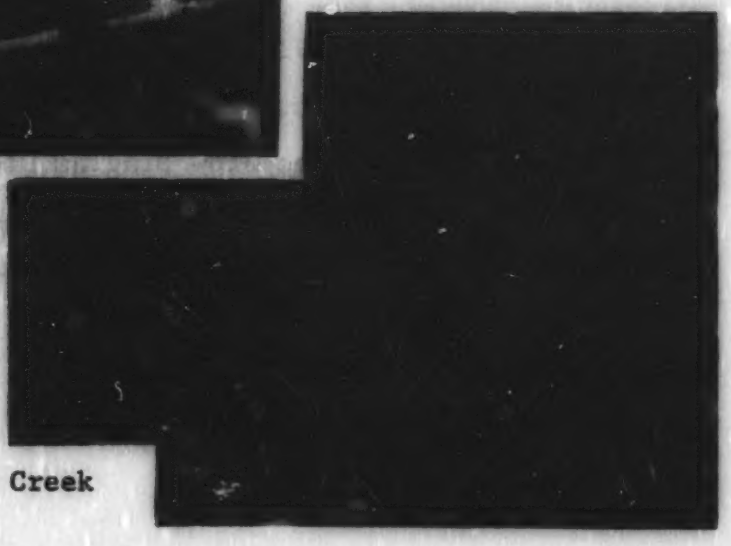
were 30 feet long, 20 feet wide, and 5 feet deep with a total capacity of 22,500 gallons and a minimum detention time of 6¼ hours. An underflow baffle was constructed in the influent. (Flow Diagram Figure #2). Foam carryover to the filter bed was prevented by the baffle. Treated water left the basin via a 6" PVC pipe to the filter bed. (Photo #10).

Sedimentation Basin
(Photo #10)

Final Filter - Flow from the sedimentation basin was routed through a distribution network constructed of 4" PVC perforated pipe. (See Flow Diagram Figure #2). To provide an even distribution of the water on the filter, small holes were cut in the pipes nearest the influent end of the

distribution network and increasingly larger holes were cut as the flow distance from the influent end increased. The filter bed consisted of approximately two feet of sand with an underlying base of two feet of crushed rock. Surface area of the filter was approximately 400 square feet. Carbon carryover onto the filter bed was raked and removed as necessary and transported to the stabilization site. An arrangement of pipes collected the filtered effluent and discharged it through two pipes to McGirts Creek. Effluent samples were collected at this point. (Photos #11 & 12).

Final Filter
(Photo #11)

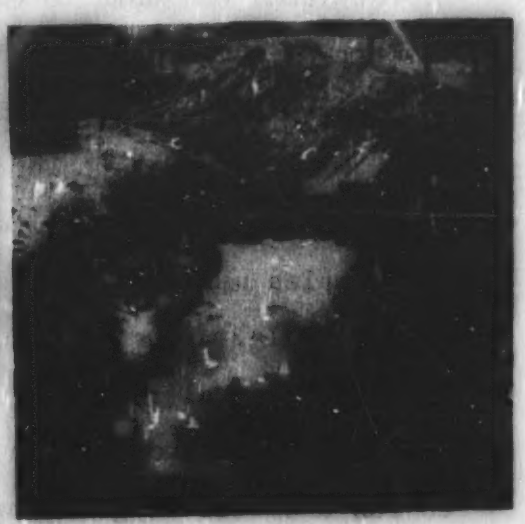


Effluent Pipes to McGirts Creek
(Photo #12)

COMMENTS

The actual siting of the treatment system was influenced by topography and available land. To construct the most efficient system, it was determined that the maximum amount of gravity flow should be used. The treatment system was, therefore, located on the so-called "downstream" side of the pits, which also provided the most land. This, in turn, resolved the other problem of what to do with the two leachate streams that ran the length of the pits. (See Figure #1). Dams were constructed on both leachate streams, near their confluence with McGirts Creek, and the water was periodically pumped out by a portable pump to the collection sump for future treatment. (Photos #13, 14, & 15).

Leachate
(Photo #13)



Temporary Filtration of
Leachate Stream
(Photo #14)

Permanent Underflow Dam on Leachate Stream
(Photo #15)

Initially this office outlined a general design plan for the treatment system and submitted it to Mosquito Control's field engineer, Mr. Tom McClamma. Using this general design, Mr. McClamma was able to construct each unit with available resources, thus reducing costs.

Surveillance and Analysis Division, due to manpower shortages, was only able to lend limited sampling and analysis support after the initial oil sludge samples. Treatment system samples were split between S&A, Athens, and the City of Jacksonville. This procedure produced a lengthy "turn around time" for actual results. In order to obtain a more rapid indication of PCB removal, the City of Jacksonville was requested to run Chemical Oxygen Demand (COD) tests. Organic contaminants

are expected in any oily waste and these contaminants will tend to occupy adsorption sites on the carbon along with the PCBs. The COD tests indicate an increase or decrease in the effectiveness of removal of the organics by the carbon. A correlation exists between removal of organics and PCB reduction, therefore, lower COD values indicate lower PCB concentrations. Also, the COD tests were less expensive and a more rapid indicator of PCB removal.

The initial discharge on September 20 was analyzed for PCBs and COD, then the system was shutdown until the results were obtained. These results indicated that the PCB concentration was below 1 ppb in the effluent and that the carbon feed rate was correct. Using the COD test, as an indicator, the PCB concentration was kept consistently below 1ppb in the effluent. Some results of effluent monitoring are shown in Table #3.

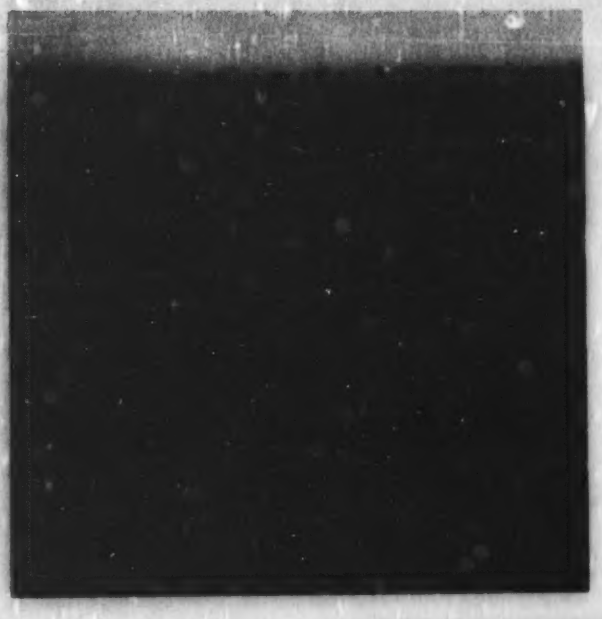
Another problem that was considered was the migration, if any, of PCBs into the groundwater table. EPA's Residual Management Branch contracted with Geraghty and Miller, Inc., to perform a groundwater study of the stabilization site. The objective of the study was to ascertain whether or not migration of hazardous wastes had occurred in the groundwater

adjacent to the waste oil pits. Three wells were sunk to obtain samples, these results are summarized in Table #4.

One of the most important aspects of the entire Whitehouse Oil Pits operation is the fact that a temporary treatment system that was able to produce an effluent containing less than 1 ppb of PCBs was erected for minimal costs. In addition, it was also observed from test results that heavy metal concentrations were reduced in the effluent. This can probably be attributed to the settling basin and sand filter, not to any chemical reaction in the treatment process.

This was an invaluable experience for future spills of organic compounds in the environment. An effective means of treatment has been demonstrated and documented for future use by other on-scene coordinators. This method will not be applicable for every hazardous material spill, but will be applicable where the waterway is small enough for total containment and treatment. Activated carbon is specific for non-polar molecules; therefore, it would be useful in almost all spills of liquid organic chemicals. However, every spill is different, so one would have to modify the design of the treatment system to meet the situation. The basic principle as described in this report should still be applicable.

In closing, the esthetic value of the work done on the stabilization site should also be noted. This is best done by comparison of Photos #16 & 17.



Early Stages of Stabilization
(Photo #16)

Stabilization Complete - May 1977
(Photo #17)

APPENDICES

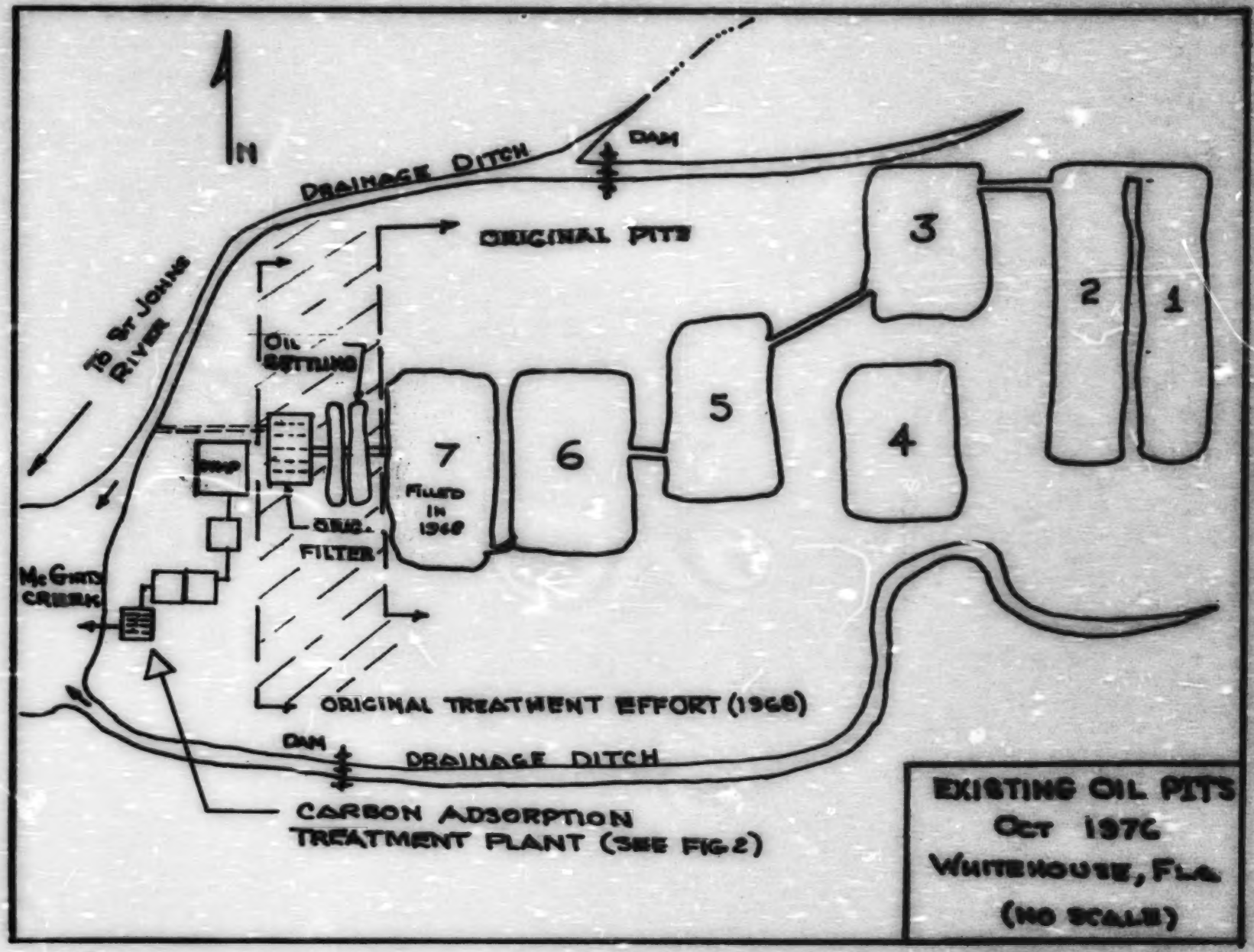

N
DRAINAGE DITCH
DAM
ORIGINAL PITS
TO ST JOHNS RIVER
OIL SETTLING
PUMP
7
FILLED IN 1968
6
5
4
3
2
1
FILTER
McGIRTS CREEK
ORIGINAL TREATMENT EFFORT (1968)
DAM
DRAINAGE DITCH
CARBON ADSORPTION TREATMENT PLANT (SEE FIG 2)
EXISTING OIL PITS
OCT 1976
WHITEHOUSE, FLA.
(NO SCALE)

FIGURE 1

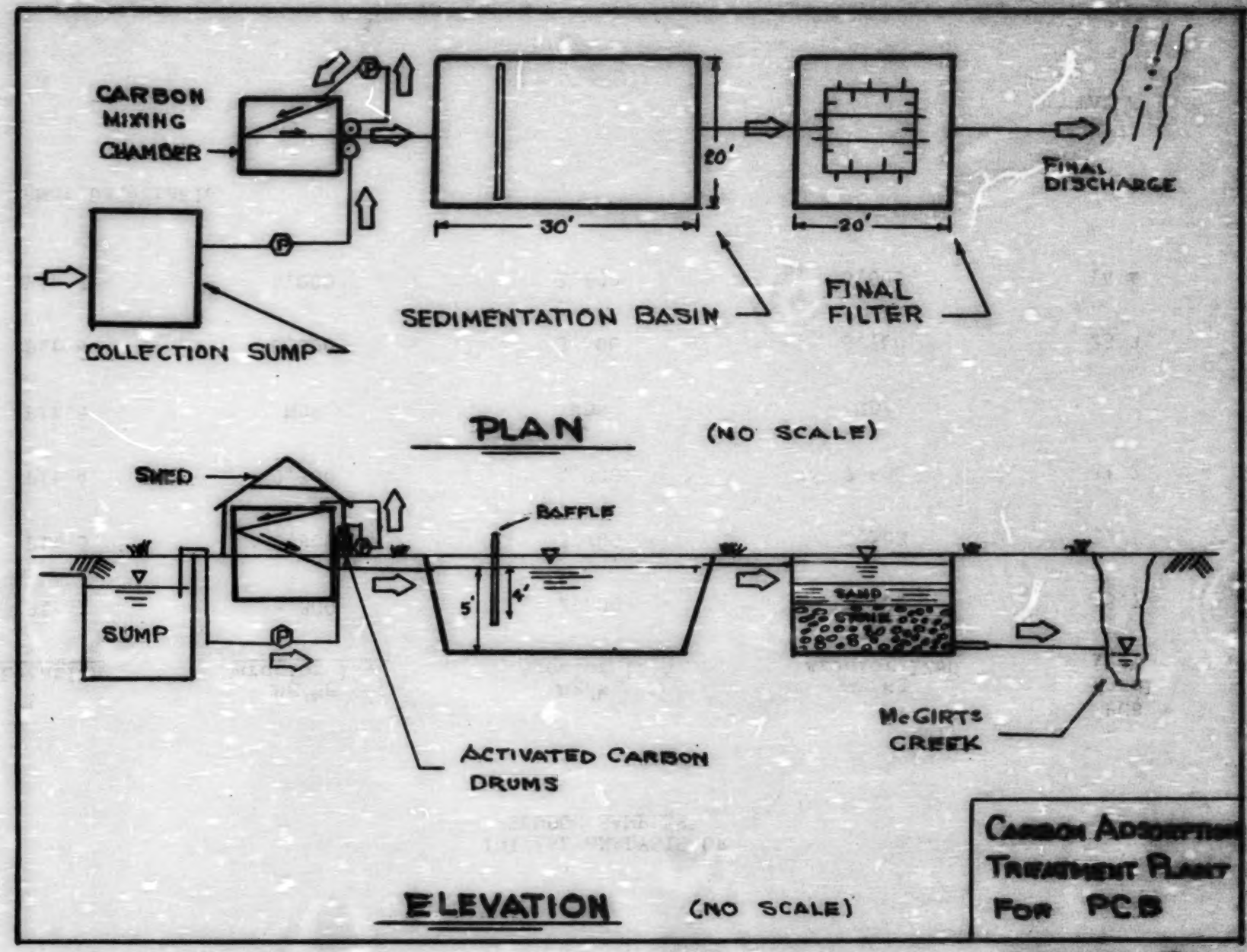

CARBON MIXING CHAMBER
COLLECTION SUMP
SEDIMENTATION BASIN
FINAL FILTER
FINAL DISCHARGE
20'
30'
20'
PLAN
(NO SCALE)
SHED
BAFFLE
SUMP
5'
4'
SAND
STONE
McGIRTS CREEK
ACTIVATED CARBON DRUMS
ELEVATION
(NO SCALE)
CARBON ADSORPTION TREATMENT PLANT FOR PCB

FIGURE 2

INITIAL ANALYSIS OF SLUDGE SAMPLES

Location	µg/kg Aroclor 1242	µg/kg Aroclor 1254	µg/kg Aroclor 1260	PCB Total (ppm)
Pit 2	3,300	2,300	3,100	8.7
Pit 3	6,900	3,700	6,500	17.1
Pit 4	9,300	4,300	7,600	21.2
Pit 5	ND*	ND*	ND*	-
Pit 6	10,000	3,500	9,700	23.3
Pit 7	6,000	2,800	5,600	14.4

*Not Detectable

TABLE 1

QUANTITATIVE ANALYSIS OF OIL SLUDGE - TOTAL METALS FROM ASHED SLUDGE WET WT. OF SLUDGE

Sample #	LEAD µg/g	COPPER µg/g	ZINC µg/g	CD µg/g	CD µg/g
2	2800	25	56.5	0.6	7.5
3	5300	37	43	0.5	11
4	1830	15	17	<0.3	4
5	1320	8	6	<0.2	8
6	2640	31	24	0.3	9
7	7060	62.5	56	0.8	12

QUALITATIVE SCAN OF OIL SLUDGE

Elements Detected in Sample From Pit 2

Lead	Rubidium	Vanadium
Cerium	Bromine	Titanium
Lanthanum	Selenium	Scandium
Barium	Arsenic	Calcium
Antimony	Gallium	Potassium
Tin	Zinc	Chlorine
Cadmium	Copper	Sulfur
Silver	Nickel	Phosphorous
Ruthenium	Cobalt	Silicon
Molybdenum	Iron	Aluminum
Zirconium	Manganese	Magnesium
Strontium	Chromium	Fluorine

TABLE 2

ANALYSES OF TREATMENT SYSTEM SAMPLES

	INFLUENT			EFFLUENT		
Date	PCB (ppb)	COD (mg/1)	Carbon (ppm)	PCB (ppb)	COD (mg/1)	% Removal PCB's
9/20/76	-	369	27.0	<0.2	66	
9/25/76	0.73	-	10.7	ND	399	
9/26/76	0.56	1,068	10.7	ND	282	
9/28/76	2.22	-	10.2	0.26	-	88
9/29/76	7.7	988	10.?	0.4	419	94
9/30	0.93	932	28.6	0.99	394	-
10/1/76	1.49	942	28.6	0.29	463	80
10/6/76	1.15	1,068	25.9	0.14	399	87
10/7/76	0.66	1,000	43.5	<0.2	571	70
10/8/76	0.62	1,225	43.5	<0.2	372	61

Surface sample taken McGirts Creek at Chaffee Road - 10/1/76 - 0.07 ppb PCB.

TABLE 3

ANALYSIS OF GROUNDWATER WELL SAMPLES

Location	ug/l PCB[1]	ug/l Phenol	ug/l Copper	ug/l Zinc	ug/l Chromium	ug/l Lead	ug/l Cadmium
Well #1	ND*	10	<10	10	<80	<50	<10
Well #2	ND*	16	<10	40	<80	<50	<10
Well #3	ND*	14	20	101	<80	128	11

[1]Minimum Detection Limit - .3 ug/l

*Not Detectable

*U.S. GOVERNMENT PRINTING OFFICE: 1977 - 743-830/4281

TABLE 4